

*Application No.: 10/624,208*  
*Amendment*

**AMENDMENTS TO THE DRAWINGS**

Please replace Figures 1D, 1E, 2A, 2C, 3, 5, 7, 12, 13, 14 and 17, with the attached Replacement Sheets. Annotated marked-up drawings are also provided that identify the changes in the above noted Figures.

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### Remarks

Claims 1, 3-27 and 29-32 are presently pending in the subject application<sup>1</sup>. Claim 31 is allowed. Claims 3, 5, 6, 7, 10, 11, 14, 15, 18-24, 27, 29 and 30 have been objected to. Claims 1, 4, 7, 9, 12, 13, 16, 17, 25, 26 and 32 have been rejected.

### Specification

The Amendments to the Specification were made to cure typographical errors and to improve the formatting of the application. Specifically, the polynomials expressed in the application were amended to place exponents into a superscript format. No new matter was introduced through these corrections.

### Claims

The Amendments to the Claims section includes amendments to claims 5, 6, 11, 14, 15, 16, 20, 22 and 29 and addition of new claims 33-37. Claim 33 was added to re-introduce the subject matter originally claimed in the first claim 28 of the original application. Claims 34-37 were added to better claim that which the applicant believes is his invention. Claims 11, 16, 20, 22 and 29 were amended to better claim that which the applicant considers his invention. Claims 5, 6, 14 and 15 were amended to place polynomials recited therein in superscript format.

Support for new claim 33 is found in claim 28 as originally filed. Support for new claims 34-37 is found at least at page 14, line 20 through page 20, line 4 and at page 30, lines 4-29.

### Claim Objections

Claim 16 has been objected to by the Examiner under 37 CFR 1.75(c) for failing to further limit the subject matter of the claim from which it depends. The applicant has amended claim 16 to recite further process over that recited in claim 13. With this change, the objection is traversed.

### Claim Rejections – 35 U.S.C. 112

Claim 9 has been rejected by the Examiner under 35 U.S.C. §112, first paragraph for failing to comply with the written description requirement. Specifically, the Examiner has stated that the concept of “six pair combinations of column elements can be equated to a data row element pair” has not been disclosed. The applicant points out, however, that at least at page 13,

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<sup>1</sup> The Examiner noted that the Preliminary Amendment filed 18 January 2005 was not entered. The Examiner has, however, canceled claims 2 and both claims 28 as a result of the Preliminary Amendment. Accordingly, the applicant has treated the claims in the present amendment as not having been modified from the claims as originally filed except for the cancellation of claims 2 and both claims 28.

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lines 18 – 20 the specification teaches that “[w]ith ts = the data byte and vu = the ECC byte and st, su, sv, tu, tv, and uv, are row couplets mirroring the data byte [Di] = st and wx, wy, wz, xy, xz and yz are column couplets also mirroring the data byte [Di] = st.” (Emphasis added). This is ample support for claim 9 and the rejection is therefore traversed.

Claim Rejections – 35 U.S.C. 102(b)

Claims 1, 4 and 12 stand rejected under 35 U.S.C. 102(b) as anticipated by U.S. Patent 6,158, 026 (“Kawahara”). The applicant has carefully studied Kawahara and believes that these claims in their present form define subject matter not taught or suggested by Kawahara.

The presently rejected claims are directed to a method for encoding a data byte for use in computer, communication and storage systems. Specifically the method includes the steps of selecting an irreducible polynomial, generating an error control code (ECC) from the polynomial and the data to be encoded, generating an encoded data matrix where elements of the matrix are based on the ECC and distributing the elements to one of multiple channels where the channel selected for a particular element is dependent upon the position of the element in the matrix.

The Examiner cites Kawahara as teaching all of the elements. In particular, the Examiner cites Kawahara at Fig. 4, elements 35-50 (recording heads) as teaching dispersing an element of the encoded data matrix to a selected one of a plurality of channels base upon a position of the element in the matrix. Kawahara teaches a method for translating data to a data form that is more reliably recorded and recovered due to the data frequency of ones and zero. Kawahara serial recording system does not, however, disperse data or introduce data redundancy into the data being recorded.

In reviewing the text supporting Fig. 4 (primarily column 7, line 20 through column 8, line 60), the applicant has found the specification silent on the point of dispersing an element to a location based on its position in the matrix. To begin with, heads 43-50 are playback heads of a recorder and it is clear that none of the data produced by the Kawahara recorder is sent to these heads. In fact, Kawahara determines which head will receive audio and video data through use of a servo 58 (see column 7, lines 59-63). Because Kawahara does not teach all of the elements present in claim 1, the rejection of claim 1 is traversed. Because claim 1 is presently in allowable form, claims 4 and 12 that depend from claim 1 are allowable as well.

Further, with respect to claim 4, the Examiner cites Kawahara as teaching the use of an eighth order polynomial (see column 2, line 35). The applicant notes that the polynomial

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referenced by the Examiner is used for generation of an M sequence to scramble data, not to generate an error correction code as presently claimed. Because Kawahara does not teach the use of the eighth order polynomial as presently claimed, the rejection of claim 4 is traversed for this additional reason.

Claim Rejections – 35 U.S.C. 103(a)

Claims 7, 12, 13, 16, 17, 25 and 26 have been rejected under 35 U.S.C. 103(a) as being obvious from Kawahara in view of U.S. Patent 4,513,420 (“Collins”). Collins is cited by the Examiner as teaching generation of an ECC through division of data by a polynomial.

Claim 13 specifically claims formation of an error correction code being in the form of d0d1d2d3d4d5d6d7e0e1e2e3e4e5e6e7. After careful review of the Collins reference no teaching or suggestion of such a code form was found or suggested. Indeed, Collins is silent on the structure of the error correction code. Accordingly, because the combination of references still does not teach or suggest all of the elements of the present claims, the rejection is traversed.

Claims 25 and 26 recite further steps to claim 13 for encoding data. Claim 25 adds the concept of arranging the matrix so that each element of the data byte is horizontally or vertically adjacent to at least three other elements of the data byte. Claim 26 claims the step of making arranging the matrix so that each element of the data byte and the error control byte is a row of the matrix. As noted above, Collins is silent on the structure of the error correction code and the matrix produced thereby. Accordingly, because the combination of references still does not teach or suggest all of the elements of the present claim. The rejection is traversed. Further, because claims 25 and 26 depend from allowable claim 13, claims 25 and 26 are allowable as well.

For at least the reason that claims 7 and 12 are dependent upon allowable claim 1, claims 7 and 12 are allowable as well. For at least the reason that claims 16 and 17 are dependent upon allowable claim 13, claims 16 and 17 are allowable as well.

Drawing

In the drawings, a number of replacement sheets are submitted to correct typographical errors or to enhance the readability of the figures. All of the drawing figure changes, with the exception of Figure 1E and 3, have been amended to look as they did in United States Provisional Patent Application Nos. 60/399,635 entitled “Data Dispersion and Mirroring Method

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with Fast Dual Erasure Correction and Multi-Dimensional Capabilities" filed on July 29, 2002, and 60/460,545 entitled "Composite Data Protection Method for Micro Level Data" filed April 4, 2003. Since these applications were incorporated into the present application by reference, no new matter has been added through these changes.

With respect to Figure 1E, the changes are supported by at least the text in paragraphs 0077 through 0080.

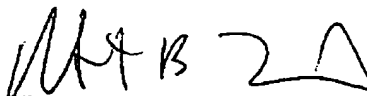
With respect to Figure 3, the changes are supported by at least the text in paragraph 0062.

The Figures submitted with the Preliminary Amendment were not identified as "Replacement Sheets." The applicant has so identified the Figures submitted with this Amendment.

If any fee is required for entry of this paper, the Commissioner is authorized to charge Deposit Account No. 06-0029 and is requested to notify us of the same.

Respectfully Submitted,

ROBERT HALFORD

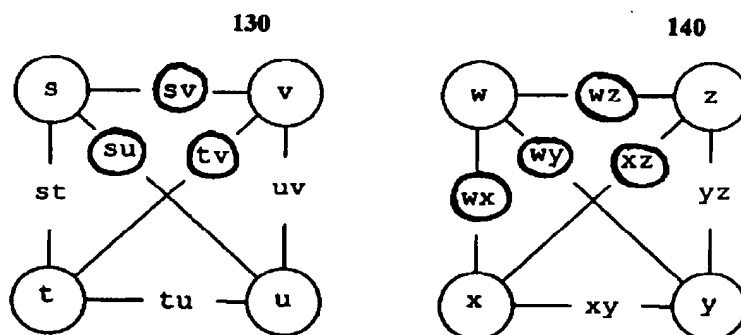


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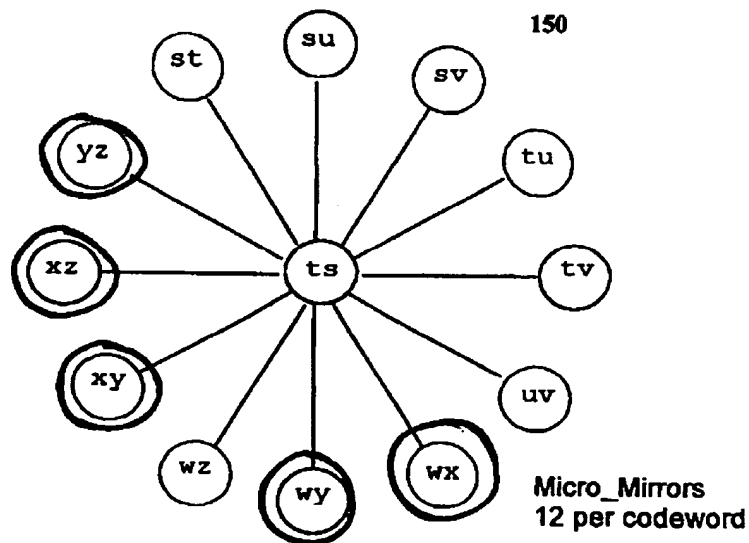
Robert B. Leonard, #33,946  
Telephone: (612) 766-8578  
Customer No. 25764

Date: April 17, 2005

M2:20789300.02



**FIG 1D**



**FIG 1E**

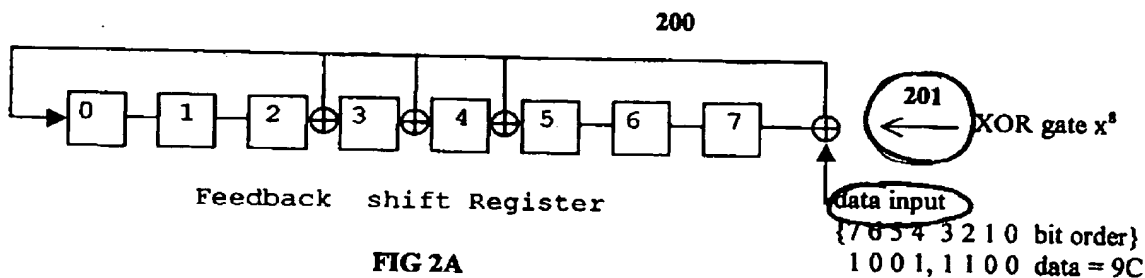


FIG 2A

0	0	0	0	0	0	0	0	
1	0	0	1	1	1	0	0	results after 1 shift
0	1	0	0	1	1	1	0	results after 2 shifts
0	0	1	0	0	1	1	1	results after 3 shifts
0	0	0	1	0	0	1	1	results after 4 shifts
0	0	0	0	1	0	0	1	results after 5 shifts
0	0	0	0	0	1	0	0	results after 6 shifts
0	0	0	0	0	0	1	0	results after 7 shifts
0	0	0	0	0	0	0	1	results after 8 shifts, ECC = 80

FIG 2B

210

$$\begin{aligned} e_0 &= d_0 + d_3 + d_4 + d_5 + d_6 \\ e_1 &= d_1 + d_4 + d_5 + d_6 + d_7 \\ e_2 &= d_2 + d_5 + d_6 + d_7 \\ e_3 &= d_0 + d_4 + d_5 + d_7 \\ e_4 &= d_0 + d_1 + d_3 + d_4 \\ e_5 &= d_0 + d_1 + d_2 + d_3 + d_6 \\ e_6 &= d_1 + d_2 + d_3 + d_4 + d_7 \\ e_7 &= d_2 + d_3 + d_4 + d_5 \end{aligned}$$

per example

$$\begin{aligned} 0 + 1 + 1 + 0 + 0 &= 0 \\ 0 + 1 + 0 + 0 + 1 &= 0 \\ \underline{1 + 0 + 0 + 1} &= 0 \\ 0 + 1 + 0 + 1 &= 0 \\ 0 + 0 + 1 + 1 &= 0 \\ 0 + 0 + 1 + 1 + 0 &= 0 \\ 0 + 1 + 1 + 1 + 1 &= 0 \\ 1 + 1 + 1 + 0 &= 1 \\ \text{ECC} &= 80 \text{ for data byte } 9C \end{aligned}$$

FIG 2C

220

$$\begin{aligned} d_0 &= e_2 + e_3 + e_4 + e_5 \\ d_1 &= e_0 + e_3 + e_4 + e_5 + e_6 \\ d_2 &= e_1 + e_4 + e_5 + e_6 + e_7 \\ d_3 &= e_3 + e_4 + e_6 + e_7 \\ d_4 &= e_0 + e_2 + e_3 + e_7 \\ d_5 &= e_0 + e_1 + e_2 + e_5 \\ d_6 &= e_0 + e_1 + e_2 + e_3 + e_6 \\ d_7 &= e_1 + e_2 + e_3 + e_4 + e_7 \end{aligned}$$

per example

$$\begin{aligned} 0 + 0 + 0 + 0 &= 0 \\ 0 + 0 + 0 + 0 + 0 &= 0 \\ 0 + 0 + 0 + 0 + 1 &= 1 \\ 0 + 0 + 0 + 1 &= 1 \\ 0 + 0 + 0 + 1 &= 1 \\ 0 + 0 + 0 + 0 &= 0 \\ 0 + 0 + 0 + 0 + 0 &= 0 \\ 0 + 0 + 0 + 0 + 1 &= 1 \\ \text{data byte} &= 9C \text{ for ECC} = 80 \end{aligned}$$

FIG 2D

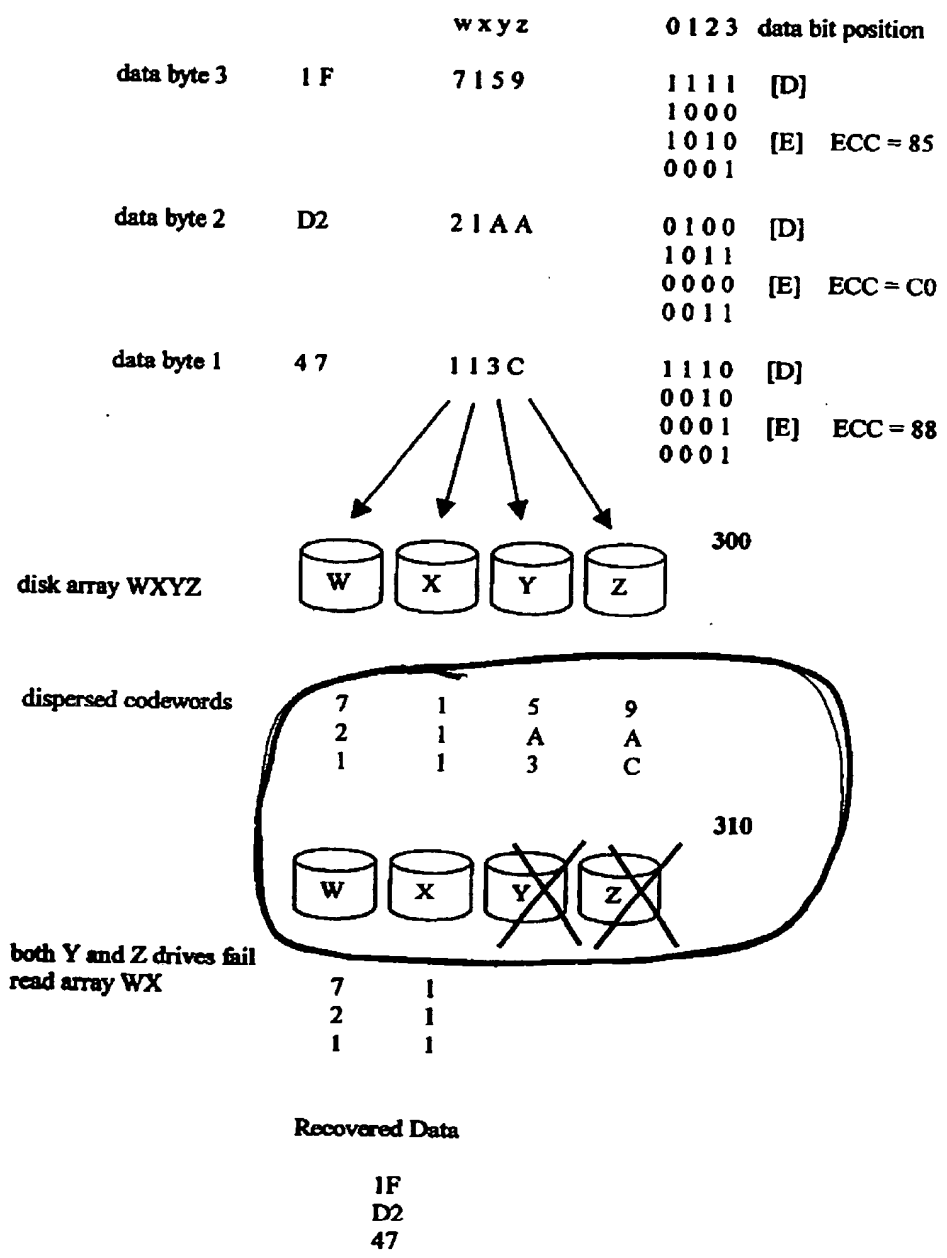


FIG 3



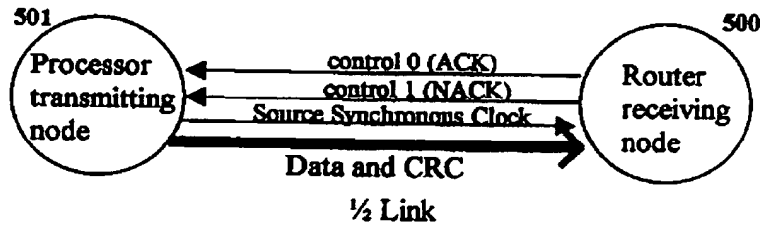
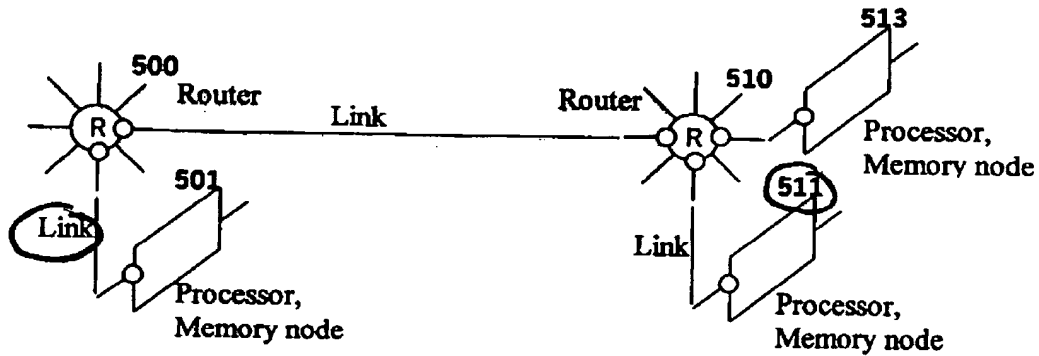


FIG 5

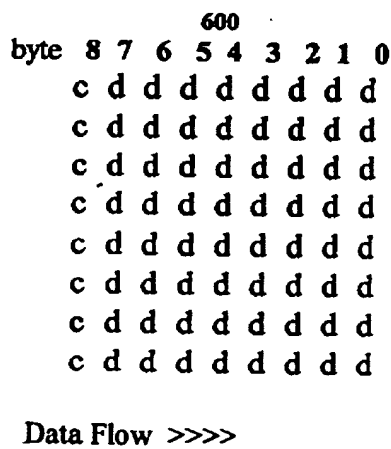


FIG 6A

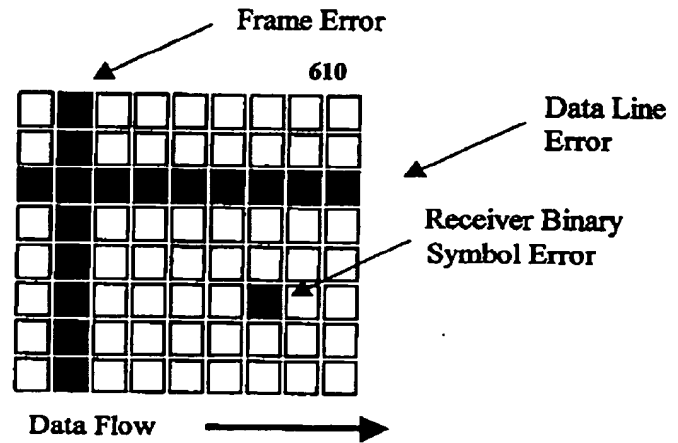


FIG 6B

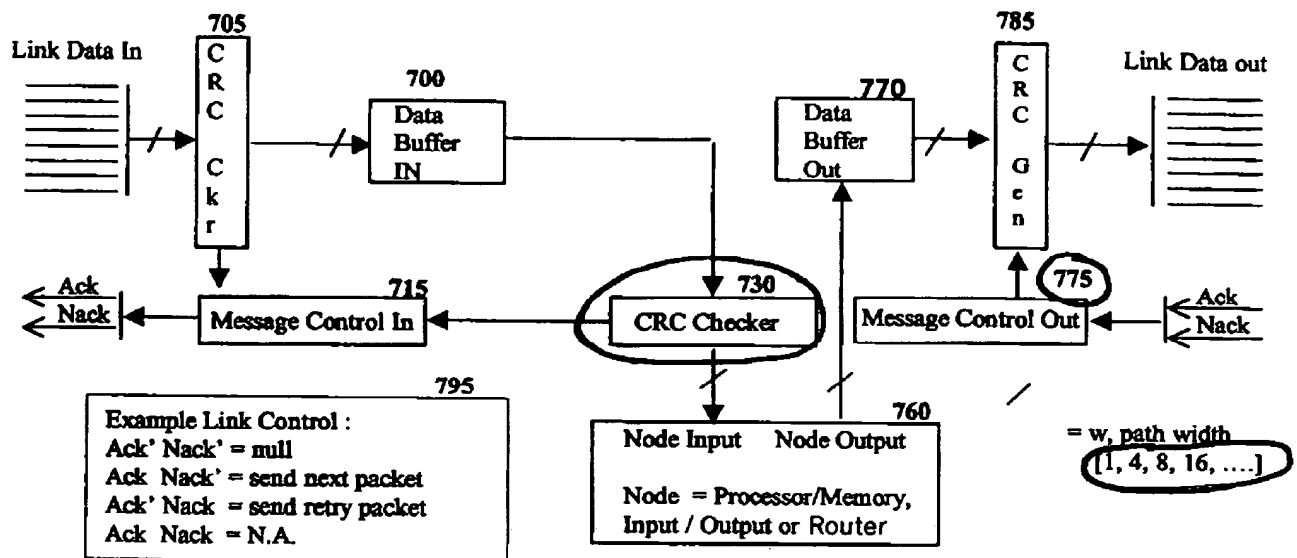


FIG 7

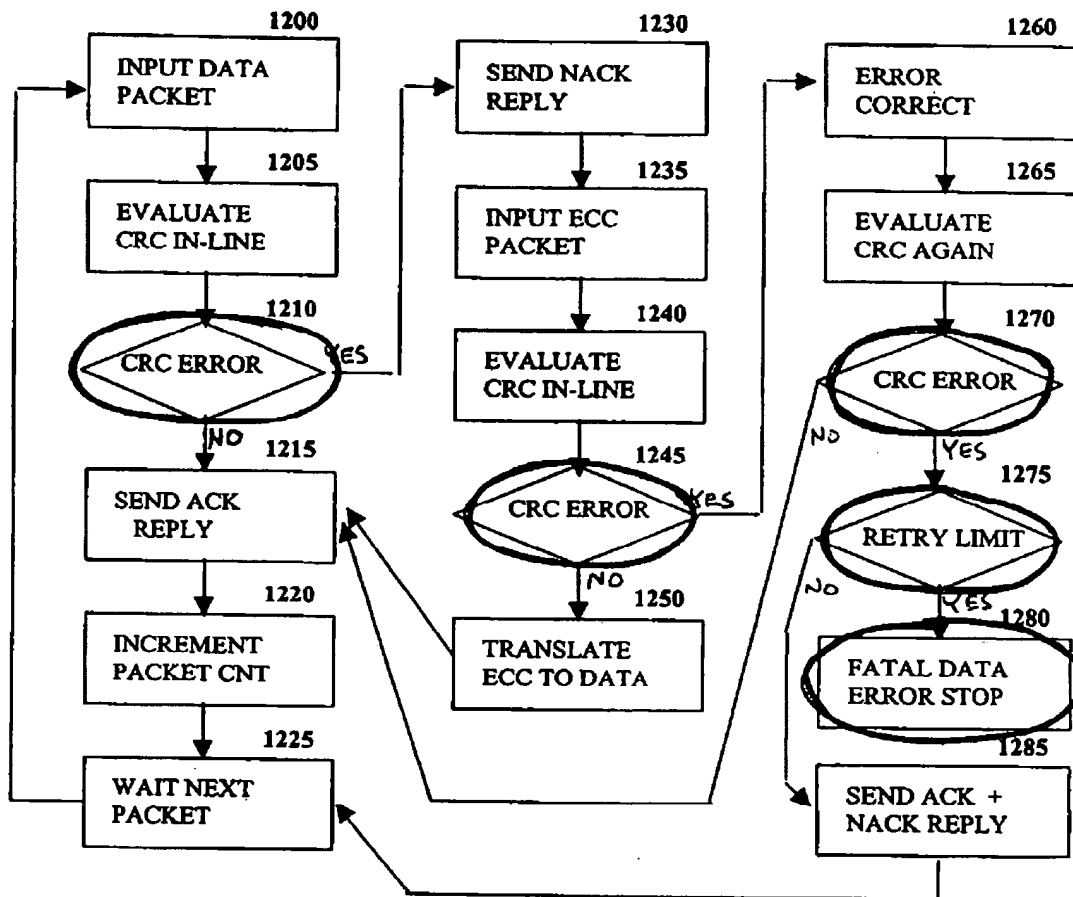


FIG 12

[E]	1301	[D]	1300
c6uc2u u30 u26 u22 u18 u14 u10 u06 u02		c4sc0s s28 s24 s20 s16 s12 s08 s04 s00	
c6vc2v v30 v26 v22 v18 v14 v10 v06 v02		c4tc0t t28 t24 t20 t16 t12 t08 t04 t00	
c7uc3u u31 u27 u23 u19 u15 u11 u07 u03		c5sc1s s29 s25 s21 s17 s13 s09 s05 s01	
c7vc3v v31 v27 v23 v19 v15 v11 v07 v03		c5tc1t t29 t25 t21 t17 t13 t09 t05 t01	
c4uc0u u28 u24 u20 u16 u12 u08 u04 u00		c6sc2s s30 s26 s22 s18 s14 s10 s06 s02	
c4vc0v v28 v24 v20 v16 v12 v08 v04 v00		c6tc2t t30 t26 t22 t18 t14 t10 t06 t02	
c5uc1u u29 u25 u21 u17 u13 u09 u05 u01		c7sc3s s31 s27 s23 s19 s15 s11 s07 s03	
c5vc1v v29 v25 v21 v17 v13 v09 v05 v01		c7tc3t t31 t27 t23 t19 t15 t11 t07 t03	

Data Flow &gt;&gt;&gt;

&lt;&lt;&lt; NACK

&lt;&lt;&lt; ACK

FIG 13

[E]	1401	[D]	1400
c6uc2u u30 u26 u22 u18 u14 u10 u06 u02		<u>c4sc0s</u> s28 s24 s20 s16 s12 s08 s04 <u>s00</u>	
c6vc2v v30 v26 v22 v18 v14 v10 v06 v02		c4tc0t t28 t24 t20 t16 t12 t08 t04 t00	
c7uc3u u31 u27 u23 u19 u15 u11 u07 u03		c5sc1s s29 s25 s21 s17 s13 s09 s05 s01	
c7vc3v v31 v27 v23 v19 v15 v11 v07 v03		c5tc1t t29 t25 t21 t17 t13 t09 t05 t01	
c4uc0u u28 u24 u20 u16 u12 u08 u04 <u>u00</u>		c6sc2s s30 s26 s22 s18 s14 s10 s06 s02	
c4vc0v v28 v24 v20 v16 v12 v08 v04 <u>v00</u>		c6tc2t t30 t26 t22 t18 t14 t10 t06 t02	
c5uc1u u29 u25 u21 u17 u13 u09 u05 u01		c7sc3s s31 s27 s23 s19 s15 s11 s07 s03	
c5vc1v v29 v25 v21 v17 v13 v09 v05 v01		c7tc3t t31 t27 t23 t19 t15 t11 t07 t03	

Data Flow &gt;&gt;&gt;

&lt;&lt;&lt; NACK

&lt;&lt;&lt; ACK

FIG 14

Begin with Byte 00

Transmitted

s00t00 = 18h (data = ts = 81h)

u00v00 = 77h (ECC = vu = 77h)

Received

s00t00 = 1Ah (data = ts = A1h)

u00v00 = 75h (ECC = vu = 57h)

So correction proceeds exactly as before in Figure 8 for byte 00.

All 32 bytes are assembled and corrected then verified via the CRC checkcode comparison.

	<u>ECC</u>	<u>Data</u>
Data byte 00 input in error is		1 0 1 0 0 0 0 1 = A1 hex.
The ECC for A1 is F8	1 1 1 1 1 0 0 0 = F8 hex.	
ECC byte 00 input in error is	0 1 0 1 0 1 1 1 = 57 hex.	
The ECC syndrome	1 0 1 0 1 1 1 1 = AF hex.	
E.P. from Table 1 = d5 & e5	0 0 1 0 0 0 0 0 = e5	and 0 0 1 0 0 0 0 0 = d5
After corrections data = 81 hex.	0 1 1 1 0 1 1 1 = 77 hex.	and 1 0 0 0 0 0 0 1 = 81 hex.

FIG 14A

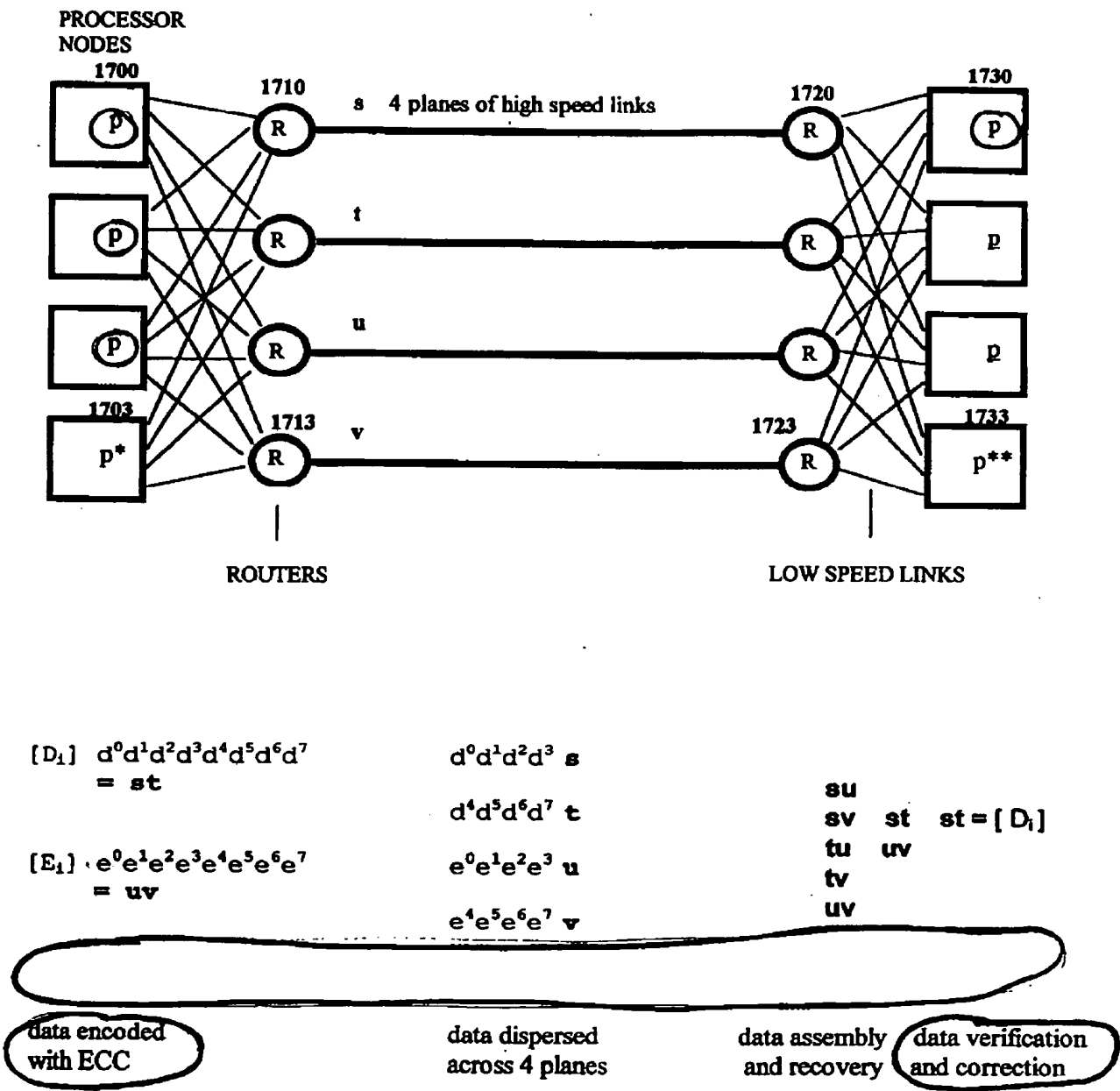


FIG 17